Abstract

Reinforced concrete is the most widely used man-made material for engineering applications in the world. Not only does it offer an abundance of favorable physical properties that enhance its appeal as a construction element, but it is also relatively inexpensive and easy to produce. This thesis study sets out to examine stress carrying capacity and membrane behavior of thin concrete plate elements under application of external loading. Potential benefits of such system solutions implemented in certain applicable settings may be far-reaching. A simple, economically attractive, and structurally feasible concrete membrane system may offer a competitive solution for shielding of load-carrying members in high-risk structures vulnerable to blast loading, facades of high-rise structures susceptible to fire and impact risk, as well as other comparable uses.

A concept of thin concrete membranes and their practicality in such applications has been analyzed with an experimental procedure discussed within this study. It was hypothesized that ultra-thin cast concrete plates reinforced with uniform welded steel fabric will develop an ability to capture, distribute and dissipate loads through membrane deformation. Physical testing on two thin concrete beams developed in lab conditions for this investigative purpose yielded promising outcomes. Upon external load application, membrane behavior characterized by deformation and partial profile recovery in mesh-reinforced concrete plates under loading and unloading cycles was observed.

Moreover, due to growing importance of higher strength concrete in the construction industry, this paper briefly attempts to outline key considerations for development of high-performance concrete. Experimental results of high-strength mix development are presented.